CLAIMS

1. An apparatus to capture images of a surrounding scene, the apparatus comprising:

a camera array bar to support a camera at a plurality of substantially parallel capture planes; and

a camera, coupled to the camera array bar, to capture a plurality of images of a surrounding scene in each of the plurality of substantially parallel capture planes as the camera moves through each of the plurality of substantially parallel capture planes.

2. An apparatus as recited in claim 1, camera comprises one or more of: a video camera, a still camera, a digital camera, a film camera, a plurality of Charge Coupled Device (CCD) elements.

3. An apparatus as recited in claim 1, further comprising another camera, coupled to the camera array bar, to capture images in one of the plurality of substantially parallel capture planes while the camera captures images in another of the plurality of substantially parallel capture planes.

4. An apparatus as recited in claim 1, wherein the camera is moveably coupled to the camera array bar such that the camera can be moved to positions of the camera array bar that coincide with the plurality of substantially parallel capture planes.

5. An apparatus as recited in claim 1, wherein the camera array bar is substantially perpendicular to the plurality of substantially parallel capture planes.

6. An apparatus as recited in claim 5, further comprising a second camera array bar, substantially perpendicular to the plurality of substantially parallel capture planes, to support another camera at the plurality of substantially parallel capture planes.

7. An apparatus as recited in claim 1, wherein the camera is configured to capture slit images.

8. An apparatus as recited in claim 1, wherein the camera is configured to capture whole area images.

9. An apparatus as recited in claim 1, wherein the camera is coupled to the camera array bar to move through each of the plurality of substantially parallel capture planes in a pattern of rotation and to capture images in a direction tangential to the pattern of rotation.

10. An apparatus as recited in claim 1, wherein the camera is coupled to the camera array bar to move through each of the plurality of substantially parallel capture planes in a pattern of rotation and to capture images in a direction along a radial of the pattern of rotation.

11. An apparatus to capture images of a surrounding scene, the apparatus comprising:

a camera array bar to support a plurality of cameras at a plurality of substantially parallel capture planes; and

a plurality of cameras, coupled to the camera array bar, each camera to capture a plurality of images of the surrounding scene in one of the plurality of substantially parallel capture planes as the camera rotates through the one of the plurality of substantially parallel capture planes.

12. An apparatus as recited in claim 11, camera comprises one or more of: a video camera, a still camera, a digital camera, a film camera, a plurality of Charge Coupled Device (CCD) elements.

13. An apparatus as recited in claim 11, wherein the camera array bar is substantially perpendicular to the plurality of substantially parallel capture planes.

14. An apparatus as recited in claim 13, further comprising a second camera array bar, substantially perpendicular to the plurality of substantially parallel capture planes, to support another plurality of cameras at the plurality of substantially parallel capture planes.

15. An apparatus as recited in claim 11, wherein each of the plurality of cameras is configured to capture slit images.

16. An apparatus as recited in claim 11, wherein each of the plurality of cameras is configured to capture whole area images.

17. An apparatus as recited in claim 11, wherein each of the plurality of cameras is coupled to the camera array bar to move through one of the plurality of substantially parallel capture planes in a pattern of rotation and to capture images in a direction tangential to the pattern of rotation.

18. An apparatus as recited in claim 11, wherein each of the plurality of cameras is coupled to the camera array bar to move through one of the plurality of substantially parallel capture planes in a pattern of rotation and to capture images in a direction along a radial of the pattern of rotation.

19. A method of capturing a surrounding scene, the method comprising:

rotating one or more cameras through a plurality of capture planes that are substantially parallel to one another, wherein the one or more cameras are positioned to look outward toward the surrounding scene; and

capturing, by each of the one or more cameras, a plurality of images of the surrounding scene as the one or more cameras rotate through the plurality of capture planes.

20. A method as recited in claim 19, wherein the rotating comprises rotating the one or more cameras through the plurality of capture planes in a substantially circular pattern of rotation.

21. A method as recited in claim 19, wherein the capturing comprises capturing slit images from each of the one or more cameras.

22. A method as recited in claim 19, wherein the capturing comprises capturing whole images from each of the one or more cameras.

23. A method as recited in claim 19, wherein the rotating comprises concurrently rotating each of a plurality of cameras through a different one of the plurality of capture planes.

24. A method as recited in claim 19, wherein the rotating comprises rotating the one or more cameras through the plurality of capture planes in a pattern of rotation, and wherein the capturing comprises capturing images in a direction tangential to the pattern of rotation.

25. A method as recited in claim 19, wherein the rotating comprises rotating the one or more cameras through the plurality of capture planes in a pattern of rotation, and wherein the capturing comprises capturing images in a direction along a radial of the pattern of rotation.

26. A method as recited in claim 19, further comprising combining the plurality of captured images to generate a scene data file corresponding to the scene.

27. A method as recited in claim 19, further comprising saving the plurality of captured images.

28. A method as recited in claim 27, wherein the one or more cameras each have a longitudinal field of view, and wherein the saving comprises, for each of the one or more cameras, saving only a portion of each image captured by the camera based on the longitudinal field of the camera and an anticipated subsequent viewing plane, wherein the anticipated subsequent viewing plane is a plane substantially parallel to the plurality of capture planes in which an observer is determined to be located in for subsequent rendering of views of the scene.

29. A method as recited in claim 28, wherein the anticipated subsequent viewing plane is one of the plurality of capture planes that is in substantially the middle of the plurality of capture planes.

30. A method as recited in claim 28, wherein the saved portion of each image for a camera is determined by determining a first line from a central point of rotation on the anticipated subsequent viewing plane and a center of a longitudinally adjacent camera, determining a second line that is parallel to the first line and extends from a

center of the camera, determining a third line from the central point of rotation to a longitudinal field of view limit, and identifying as the saved portion the portion of the captured image that is located between the second line and the third line.

31. One or more computer-readable memories containing a computer program that is executable by a processor to perform the method recited in claim 19.

32. One or more computer-readable media having stored thereon a computer program that, when executed by one or more processors of a computer, causes the one or more processors to perform acts including:

receiving a plurality of images of a surrounding scene that were captured from a plurality of different locations in a plurality of capture planes; and

combining the plurality of images into a scene data file.

33. One or more computer-readable media as recited in claim 32 of rotation in different ones of the plurality of capture planes, and wherein the combining comprises generating a high image comprising a concatenation of images captured at the subset of the plurality of different locations.

34. One or more computer-readable media as recited in claim 32, wherein the surrounding scene comprises a synthetic scene.

35. One or more computer-readable media as recited in claim 32, wherein the receiving comprises receiving a plurality of images of surrounding scene that were captured by one or more cameras.

36. One or more computer-readable media as recited in claim 35, wherein the one or more cameras each have a longitudinal field of view, and wherein the combining comprises, for each of the one or more cameras, saving into the scene data file only a portion of each image captured by the camera based on the longitudinal field of the camera and an anticipated subsequent viewing plane, wherein the anticipated subsequent viewing plane is a plane substantially parallel to the plurality of capture planes in which an observer is determined to be located in for subsequent rendering of views of the scene.

37. One or more computer-readable media as recited in claim 36, wherein the anticipated subsequent viewing plane is one of the plurality of capture planes that is in substantially the middle of the plurality of capture planes.

38. One or more computer-readable media as recited in claim 36, wherein the saved portion of each image for a camera is determined by determining a first line from a central point of rotation on the anticipated subsequent viewing plane and a center of a longitudinally adjacent camera, determining a second line that is parallel to the first line and extends from a center of the camera, determining a third line from the central point of rotation to a longitudinal field of view limit, and identifying as the saved portion the portion of the captured image that is located between the second line and the third line.

39. A method of rendering a view of a surrounding scene, the method comprising:

determining, for the view to be rendered, a viewing position representing a location of an observer that is observing the surrounding scene; and

for each pixel in an image to be rendered as a representation of the view of the surrounding scene,

determining a viewing ray passing through the pixel in a direction of viewing of the observer, and

selecting which of a plurality of longitudinally adjacent capture images is to be used to determine a display value for the pixel.

40. A method as recited in claim 39, wherein the surrounding scene is defined by a capture cylinder including a plurality of longitudinal image arrays generated from a plurality of capture images.

41. A method as recited in claim 40, wherein the selecting further comprises:

determining an intersection point between the viewing ray and the capture cylinder; and

using the intersection point to determine which one or more of the plurality of longitudinal image arrays to use to determine the display value for the pixel.

42. A method as recited in claim 41, further comprising interpolating, based on the plurality of longitudinal image arrays, to determine the display value for the pixel if more than one of the plurality of image arrays is used.

43. A method as recited in claim 41, wherein the selecting further comprises determining, based on the intersection point, which one or more of a plurality of image columns in each of the one or more of the plurality of longitudinal image arrays to use to determine the display value for the pixel.

44. A method as recited in claim 43, further comprising interpolating, based on the plurality of image columns, to determine the display value for the pixel if more than one of the plurality of image columns is used.

45. A method as recited in claim 43, wherein determining which one or more of the plurality of image columns to use comprises:

calculating an angle between the viewing ray and a camera direction at the intersection point; and

identifying the one or more of the plurality of image columns based on the calculated angle.

46. A method as recited in claim 43, wherein the selecting further comprises determining, based on an elevation angle of the viewing ray, which one or more longitudinally adjacent capture images to use to determine the display value for the pixel.

47. A method as recited in claim 46, wherein the selecting further comprises determining, based on the elevation angle of the viewing ray, which one or more pixels from the one or more capture images to use to determine the display value for the pixel.

48. A method as recited in claim 39, further comprising rendering a new view of the surrounding scene in response to movement of the observer in one or more of two dimensions.

49. A method as recited in claim 39, further comprising rendering a new view of the surrounding scene in response to movement of the observer in one or more of three dimensions.

50. A method as recited in claim 49, wherein the surrounding scene is defined by a capture cylinder generated from a plurality of capture images, and wherein the observer is able to move within the capture cylinder but is constrained such that the field of view of the observer does not exceed the capture cylinder.

51. A method as recited in claim 39, wherein the surrounding scene is defined by a capture cylinder generated from a plurality of capture images, and wherein the observer is able to move within the capture cylinder but is constrained from moving outside the capture cylinder.

52. A method as recited in claim 39, wherein the surrounding scene is defined by a capture cylinder generated from a plurality of capture images, and wherein the observer is able to move within the capture cylinder but is constrained from moving outside either the capture cylinder or a circle that is substantially parallel to the ends of the cylinder.

53. A method as recited in claim 39, further comprising concurrently rendering another view of the surrounding scene, wherein the rendered view corresponds to a viewing position of one eye of an eye pair and the other rendered view corresponds to a viewing position of another eye of the eye pair.

54. A method as recited in claim 53, further comprising rendering a new view for each eye of the eye pair in response to movement of the eye pair in one or more of three dimensions.

55. A method as recited in claim 53, further comprising using a two-body rigid object model to describe motion of the eye pair.

56. A method as recited in claim 53, wherein the surrounding scene is defined by a capture cylinder generated from a plurality of capture images, and wherein the eye pair is able to move within the capture cylinder but is constrained such that neither eye of the eye pair can move outside the capture cylinder.

57. A method as recited in claim 53, wherein the surrounding scene is defined by a capture cylinder generated from a plurality of capture images, and wherein the eye pair is able to move within the capture cylinder but is constrained such that neither eye of the eye pair can move outside either the capture cylinder or a circle that is substantially parallel to the ends of the cylinder.

58. One or more computer-readable memories containing a computer program that is executable by a processor to perform the method recited in claim 39.

59. One or more computer-readable media having stored thereon a computer program that, when executed by one or more processors of a computer, causes the one or more processors to perform acts including:

determining, for a view of a surrounding scene to be rendered, a viewing position representing a location of a point of view inside the scene, wherein the surrounding scene is defined by a capture cylinder including a plurality of longitudinal image arrays generated from a plurality of capture images; and

for each pixel in an image to be rendered as a representation of the view of the surrounding scene,

determining a viewing ray passing through the pixel in a direction of viewing corresponding to the view,

determining an intersection point between the viewing ray and the capture cylinder,

using the intersection point to determine which one or more of the plurality of longitudinal image arrays to use to determine the display value for the pixel,

determining, based on the intersection point, which one or more of a plurality of image columns in each of the one or more of the plurality of longitudinal image arrays to use to determine the display value for the pixel,

determining, based on an elevation angle of the viewing ray, which one or more longitudinally adjacent capture images corresponding to the one or more longitudinal image arrays to use to determine the display value for the pixel,

determining, based on the elevation angle of the viewing ray, which one or more pixels from the one or more longitudinally adjacent capture images from the one or more capture images to use to determine the display value for the pixel, and

determining the display value for the pixel based on the display values of each of the one or more pixels.

60. One or more computer-readable media as recited in claim 59, wherein the surrounding scene is defined by a capture cylinder generated from a plurality of capture images, and wherein the observer is able to move within the capture cylinder but is constrained from moving outside the capture cylinder.

61. One or more computer-readable media as recited in claim 59, wherein the surrounding scene is defined by a capture cylinder generated from a plurality of capture

images, and wherein the observer is able to move within the capture cylinder but is constrained from moving outside either the capture cylinder or a circle that is substantially parallel to the ends of the cylinder.

62. One or more computer-readable media as recited in claim 59, further comprising concurrently rendering another view of the surrounding scene, wherein the rendered view corresponds to a viewing position of one eye of an eye pair and the other rendered view corresponds to a viewing position of another eye of the eye pair.

63. A method for generating a rendered view image of a 3D scene for display by a computing system, the method comprising:

generating a series of concentric mosaic array images each of which comprises a plurality of slit images that collectively depict the surrounding 3D scene; and

generating a rendered view image of the 3D scene from an observer viewpoint within circular regions defined by the series of concentric mosaics using the plurality of slit images.

64. A system for generating a rendered view image of a 3D scene using concentric mosaic arrays, the system comprising:

a general purpose computing device;

a computer program comprising one or more program modules executable by the computing device; and

wherein the program modules comprise a concentric mosaic array rendering module, a concentric mosaic image capture module for capturing and combining a set of vertically aligned images obtained at a plurality of radial locations within the 3D scene into a concentric mosaic array and a concentric mosaic array scene combination module for generating a rendered view image of a 3D scene as seen by an observer having a point of view within the 3D scene.